CLAIMS

What is claimed is:

1. A photonic crystal, comprising:
   a. a phosphor matrix defining a plurality of substantially spherical voids arranged in a lattice arrangement, the phosphor matrix having a first index of refraction; and
   b. a plurality of defect regions distributed in a subset of the spherical voids, each defect region having a second index of refraction, different from the first index of refraction.

2. The photonic crystal of Claim 1, wherein the lattice arrangement comprises a triangular lattice.

3. The photonic crystal of Claim 1, wherein the lattice arrangement comprises a square lattice.

4. The photonic crystal of Claim 1, wherein the lattice arrangement comprises a diamond-shaped lattice.

5. The photonic crystal of Claim 1, wherein the first index of refraction is greater than the second index of refraction.

6. The photonic crystal of Claim 1, wherein the first index of refraction is greater than 2.8 and wherein the second index of refraction is less than the first index of refraction.

7. The photonic crystal of Claim 6, wherein the first index of refraction is 3.3 and wherein the second index of refraction is 2.4.

8. The photonic crystal of Claim 1, wherein the phosphor matrix comprises a ZnS phosphor.

9. The photonic crystal of Claim 1, wherein the phosphor matrix comprises a GaP phosphor.

10. The photonic crystal of Claim 1, wherein each void has a diameter in the range of 120 nm to 300 nm.

11. A method of making a photonic crystal, comprising the steps of:
    a. forcing a plurality of nano-structures and a plurality of defect structures into a lattice, thereby creating a plurality of interstitial spaces;
    b. repeatedly applying, through atomic layer deposition, a plurality of layers of a predetermined optical material to the plurality of nano-structures until the interstitial spaces are substantially filled with the phosphor; and
    c. subjecting the nano-structures to a reactant so as to remove the nano-spheres and form the photonic crystal.

12. The method of Claim 11, wherein the nano-structures comprise Si.

13. The method of Claim 11, wherein the nano-structures comprise nano-spheres.

14. The method of Claim 11, wherein the predetermined optical material comprises a phosphor.

15. The method of Claim 14, wherein the phosphor comprises ZnS.

16. The method of Claim 11, wherein the predetermined optical material comprises a high index material.

17. The method of Claim 11, wherein the predetermined optical material comprises a luminescent material.

18. The method of Claim 11, wherein the predetermined optical material comprises a plurality of layers, each layer selected from the group consisting of: a phosphor, a high index material, and a luminescent material.

19. The method of Claim 11, wherein the reactant comprises HF.

20. The method of Claim 11, wherein the reactant comprises an organic solvent.

21. A beam steering structure, comprising:
    a. a thin film dielectric matrix defining a plurality of evenly spaced-apart voids therein; and
    b. a material that modulates optical properties disposed in each one of the voids.

22. The beam steering structure of Claim 21, wherein the thin film dielectric matrix comprises a thin film including Si.

23. The beam steering structure of Claim 21, wherein the thin film dielectric matrix comprises a thin film including ZnS.

24. The beam steering structure of Claim 21, wherein the thin film dielectric matrix comprises a thin film including Ge.

25. The beam steering structure of Claim 21, wherein the thin film dielectric matrix comprises a thin film including GaP.

26. The beam steering structure of Claim 21, wherein the material that modulates optical properties comprises an optically non-linear material.

27. The beam steering structure of Claim 21, wherein the material that modulates optical properties comprises an electro-optic material.

28. The beam steering structure of Claim 21, wherein the material that modulates optical properties comprises a liquid crystal.

29. The beam steering structure of Claim 28, wherein the liquid crystal comprises a nematic liquid crystal.

30. The beam steering structure of Claim 29, wherein the liquid crystal is doped with a plurality of C-60 Fullerines.

31. The beam steering structure of Claim 29, wherein the liquid crystal is doped with a dye.

32. The beam steering structure of Claim 21, wherein the voids are arranged in a lattice structure.

33. The beam steering structure of Claim 32, wherein the lattice structure comprises a triangular lattice.

34. The beam steering structure of Claim 32, wherein the thin film dielectric matrix has a first side and an opposite second side, further comprising:
    a. a plurality of row electrodes evenly spaced-apart and disposed on the first side so that each void is subtended by at least one row electrode; and
    b. a plurality of column electrodes evenly spaced-apart and disposed on the second side so that each void is subtended by at least one column electrode and so that each void may be uniquely addressed by applying an excitation to a selected one of the plurality of row electrodes and a selected one of the plurality of column electrodes.

35. The beam steering structure of Claim 34, wherein the excitation comprises an electric field.

36. The beam steering structure of Claim 34, wherein the excitation comprises electromagnetic radiation.

37. The beam steering structure of Claim 34, wherein when an electric field is applied between a selected one of the row electrodes and a selected one of the column electrodes, the material that modulates optical properties disposed in the void subtended by the selected one of the row electrodes and the selected one of the column electrodes changes in an optical property so that light passing through the beam steering structure adjacent the subtended void is directed along a different path from a path that the light would have taken had the electric field not been applied.

38. The beam steering structure of Claim 37, wherein the beam is out-coupled when the electrodes are excited so that the beam steering structure is used as an optical switch.

39. The beam steering structure of Claim 37, wherein the beam blocked when the electrodes are excited so that the beam steering structure is used as an optical switch.